SOUNDNINE INC

Helping build successful monitoring systems

SIMC PCH R0
Operating Manual

Soundnine Inc Document #R011B
rev 2021-05-01

Copyright 2021 SOUNDNINE INC

Table of Contents

Copyright 2021 SOUNDNINE INC

Quick Start

The SIMC shipped sealed with new batteries, desiccant and SDHC memory card. This is the factory configuration:

- 60 minute sample period
- Logging not started

With RS232 Interface

1. Connect the serial cable[1] to either of the two MCBH-4 connectors
2. Open a terminal program and select the correct COM port. Set the baud rate to 115200, no parity, 1 stop bit, software flow control.
3. Press enter a few times to get a S9 prompt from the SIMC.
4. Send the following commands:

Command	Action	Notes
period=60	Sets the sampling period in minutes (1 to 10080)	
time=2016-06-20T133000	Sets the time	
getsd	Displays status	verify the time was set properly and there are no warning messages
Getcd	Displays configuration	
Read A	Displays sample program A	
Run A	Take sample (runs program A)	
Read sdd	Retrieves data from the SD card data file	This might take a long time – the SD card can hold a lot of data!
Read sdS	Retrieves data from the SD card status file	This might take a long time – the SD card can hold a lot of data!
start	Starts logging	

Data Recording

The SIMC records data in a text-based XML format. Data is first stored in a RAM buffer (the S file). This RAM buffer is periodically recorded to a 7 Megabyte circular FLASH memory buffer (the D file). This FLASH memory buffer is periodically recorded to the removable SDHC memory card.

While running a sample program the SIMC may write directly to the D file, skipping the S file.

The READ SDD command is the best way to retrieve data without opening the housing.

[1] Note the RS232 serial cable used for the Ultimodem is not compatible with the SIMC – the Rx and Tx lines are swapped. The DANTE serial cable is compatible with the SIMC. Using the wrong cable will not damage the SIMC.

Copyright 2021 SOUNDNINE INC

Removing the SDHC Memory Card

Always press the button and wait for the green light to flash before removing the memory card. The yellow light will flash quickly while the SIMC transfers data. Three long yellow flashes indicate a problem writing to the memory card. One green flash means all data transferred and it is safe to remove the card.

Data Format

Data downloaded from the SIMC or stored on the SDHC memory card is in a text-based XML format, similar to the format used for the DANTE controller. Each sample is enclosed in a SIMC Sample tag and data recorded from each serial port (including the internal Ultimodem) are wrapped in one or more SampleData tags.

Depending on the sample program some data may not be recorded. The sample program can start and stop logging of data from any port at any time with the LOG command. Note that the DEBUGLEVEL setting overrides the sample program LOG command.

Opening and Closing the Housing

Opening

If there is any indication of water inside the pressure housing then handle it with caution! Rattling or sloshing inside the housing, hissing or other noises may indicate water intrusion in the housing. If there is any chance the housing might contain water then please wear safety glasses and chemical resistant gloves – there could be pressure inside the housing or hazardous chemicals if the battery leaked. Please do not ship or transport the housing if it may have water in it. The safest way to release internal pressure is to wait several hours, then loosen the MCBH connector one turn and wait another hour.

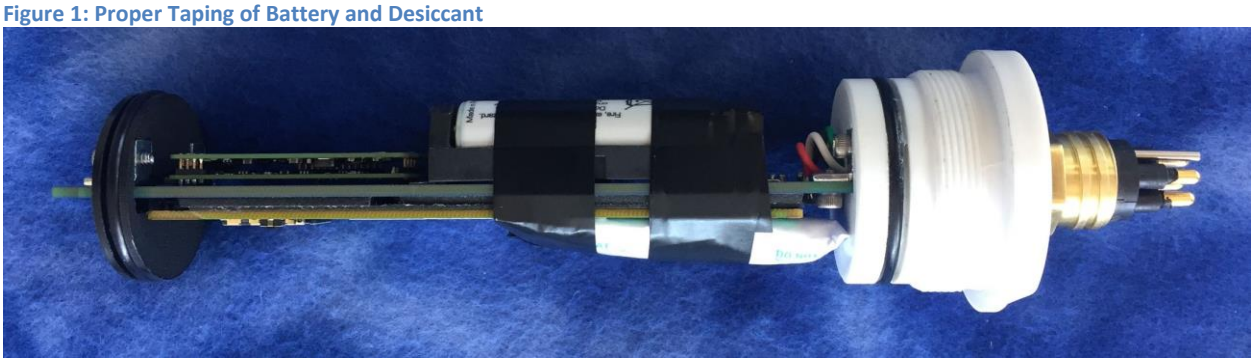
1. Upon recovery rinse the housing with fresh water and dry it off.
2. Wait for the housing to reach room temperature. If the housing is below room temperature when opened then water may condense on and damage the electronics.
3. Disconnect any cables from the endcap.
4. Use the supplied plastic wrench to loosen the endcap
5. While holding the housing vertical with the endcap facing down, unscrew the endcap and gently pull the endcap down. This orientation is required to prevent water droplets from entering the electronics.
6. Wipe the endcap and o-ring with a lint-free cloth to remove any water droplets released from the threads on the endcap.
7. After completely removing the endcap and electronics assembly, gently wipe the inside edge of the housing wit a lint-free cloth to remove any water.
8. Remove the desiccant bag and set it aside. The desiccant cannot be reused unless properly recharged (heat to 60C for three hours).

Copyright 2021 SOUNDNINE INC

Sealing

1. Inspect the o-ring for tears or any irregularity. Wipe it clean if necessary – make sure there are no hairs, sand, water or dirt on the o-ring or in the o-ring groove. If the o-ring does not look perfect and clean then replace it.
2. If the o-ring is new or feels dry then lubricate it with a small amount of Molykote M44.
3. Make sure the o-ring is installed uniformly in the groove
4. Place a new or recharged desiccant bag on the circuit board on the opposite side from the battery.
5. ⚠ Wrap a piece of electrical tape around the desiccant and the battery. This tape both holds the desiccant in place and holds the batteries in place. Without this tap there is a chance of intermittent battery disconnection from impact or strumming.
6. Slide the electronics assembly gently into the housing, being careful not to scrape the circuit boards against the o-ring sealing surface.
7. Gently turn the endcap to tighten the threads until the housing closes. Gently hand-tight is enough – do not overtighten or tighten with wrench.

Figure 1: Proper Taping of Battery and Desiccant



Command Set

Commands

Commands are not case sensitive. All commands must end with a carriage return (CR, '\r') character (automatically generated by a terminal program when you press enter). If a line feed character follows (LF, '\n') it will be ignored.

Any arguments or parameters may be separated by either a space or an equals sign(=). Note that SIMC accepts '=' or a space, but not both.

Copyright 2021 SOUNDNINE INC

Status Commands

GETCD

Displays configuration.

```
S9>getcd
<Config type='SIMC' sn='S0P2' v='0'>
<Hardware>
  <Assembly></Assembly>
  <Firmware>SIMC V0.26D</Firmware>
</Hardware>
<Cal>
  acx=0
  acy=0
  acz=0
  asx=16384
  asy=16384
  asz=16384
  bcx=0
  bcy=0
  bcz=0
  bsx=16384
  bsy=16384
  bsz=16384
</Cal>
<Settings>
  period=60
  debugLevel=0
  amode=2
  arate=4
  ascale=0
  STOPPED
</Settings></Config>
```

GETSD

Displays sensor status. This includes the battery voltage, memory status and SD card status. It is common for the sensor to pause for a moment during the GETSD command while the SD card initializes (this pause does not interrupt sampling).

Warnings are displayed in the GETSD response if the memory card is not installed or cannot be written to. These warnings mean the sensor cannot save data to the memory card and data recording is limited to the 7 megabyte internal memory. These are the two warning messages:

Copyright 2021 SOUNDNINE INC

No memory card installed:

```
S9>getsd
<Status type='SIMC' sn='S0P2' v='0'>
<DataBuffer>
  nextWrite=721669
  not saved=773
  total=773
</DataBuffer>
<SDHC_CARD>
  ***WARNING:  SDHC MEMORY CARD NOT INSTALLED!***
</SDHC_CARD>
  lastSampleTime=2021-04-01T12:22:11
  TIME=2021-04-01T12:40:35
  STOPPED
</Status>
```

Cannot write to memory card:

```
S9>getsd
<Status type='SIMC' sn='S0P2' v='0'>
<DataBuffer>
  nextWrite=721669
  not saved=773
  total=773
</DataBuffer>
<SDHC_CARD>
  SDHC card installed
  ***WARNING: 71480 DATA BYTES NOT SAVED TO CARD!***
  ***WARNING: 603 STATUS BYTES NOT SAVED TO CARD!***
  <File  Name='none'  Size='0' />
  <File  Name='none' Size='0' />
</SDHC_CARD>
  lastSampleTime=2021-04-01T12:22:11
  TIME=2021-04-01T12:40:35
  STOPPED
</Status>
```


Copyright 2021 SOUNDNINE INC

This is the GETSD response when the memory card is working properly:

```
S9>getsd
<Status type='SIMC' sn='S0P2' v='0'>
<DataBuffer>
  nextWrite=721669
  not saved=773
  total=773
</DataBuffer>
<SDHC_CARD>
  SDHC card installed
  <File  Name='S9S0P2.TXT'  Size='773' />
  <File  Name='S9S0P2S.TXT' Size='2.0KB' />
</SDHC_CARD>
  lastSampleTime=2021-04-01T12:22:11
  TIME=2021-04-01T12:40:35
  STOPPED
</Status>
```

GETEC

Displays event counters. Event counters are a useful debugging tool for S9. Most events to not indicate a problem. If you are concerned about events recorded on your device please feel free to forward the GETEC response to S9, along with the status log file from the SD card.

```
S9>getec
<EventData>
numEvents = 4
nextAddr = 70A0
   0, 04BB6D, SDR:4-1
   1, 04BB6D, SDRC2:0-0
   2, 04BB6D, SDR:4-0
   3, 04BB6E, SD1RS:0-0
</EventData>
```

In the example above the events were SDR, SDRC2, SDR, and SD1RS. These are SD memory card errors generated by removing the memory card while the SIMC was sampling.

Copyright 2021 SOUNDNINE INC

VER

Displays sensor hardware and firmware version.

```
S9>ver
HTYPE
CD AB0B0AE0, 13000002
CODE TYPE SIMC V0
FIRM SIMC V0.26D
CDATE Apr 14 2021 11:47:01
```

Configuration Commands

Refer to Configuration Settings for a full list of settings.

Copyright 2021 SOUNDNINE INC

ERASE CONFIG

This command resets all configuration settings to default values, but does not change calibration coefficients. Note the default ID setting is the last two digits of the serial number. Default settings from the GETCD response are listed here:

```
S9>getcd
<Config type='SIMC' sn='S0P2' v='0'>
<Hardware>
  <Assembly></Assembly>
  <Firmware>SIMC V0.26D</Firmware>
</Hardware>
<Cal>
  acx=0
  acy=0
  acz=0
  asx=16384
  asy=16384
  asz=16384
  bcx=0
  bcy=0
  bcz=0
  bsx=16384
  bsy=16384
  bsz=16384
</Cal>
<Settings>
  period=60
  debugLevel=0
  amode=2
  arate=4
  ascale=0
  STOPPED
</Settings></Config>
```

TIME

The TIME command both sets and displays SIMC's current time. To display the time just enter the time command by itself:

```
S>time
time=2013-11-05T01:24:47
OK - 0 Events
```

To set the time include the current time in IS0-9601 format with no time zone. Multiple time formats are allowed:

```
time=2015-11-05T14:24:47
time 2015-11-05T14:24:47  (the = is optional)
time=20151105T142447
```


Copyright 2021 SOUNDNINE INC

Note that SIMC accepts '=' or a space, but not both.
When the time is accepted the reply looks like this:

```
S9>time 2016-07-21T112000
Time changed to 2016-07-21T11:20:00
OK; 0 Events
```

Utility Commands

OPEN

Opens a serial pass through mode at specified port and baud rate. Press escape to exit the pass through mode.

`OPEN IM 19200` –Opens the IM port at 19200 baud (default for Ultimodem)
`OPEN 1 115200` --Opens serial port 1 at 115200 baud

PWROFF or SLEEP

Returns the sensor to low-power sleep mode. This command is not allowed when the USB interface is active.

RESET

Forces a full reset (like a reboot). This forces sensor to return to low-power sleep mode, abandoning all in-process activity. When sending this command over USB you must disconnect the USB cable and close the terminal program, then reconnect the cable and open the terminal program.

It is best to send an ERASE MEM command after a reset to guarantee integrity of the file system. If the SIMC was writing to flash memory (D File or ST file) during the reset then up to 64kB of data may be corrupted.

RESETEC

Resets the event counters.

File Commands

The sensor has several files in RAM, flash memory and the SDHC memory card. Files are identified by one or more letters (F, S, D, ST, STR, SD).

Available Files

Copyright 2021 SOUNDNINE INC

F File

The F file is used for scripts – most importantly firmware update scripts. Firmware update files are streamed to the F file, then the file is run with the RUN F command. The F file can may also be used for custom scripts where each line of the file is a modem command. Note that some commands cannot be used in scripts – check the 'blocks' section of the command table.

D File

The D file is a 7 Mbyte circular buffer for ASCII data. This file is too large to read over inductive modem, but it can be read in the USB interface. Data in the D file is periodically copied to the SDHC memory card.

S File

The S file is a short RAM buffer of recent samples, typically less than 2KB. Note that the GETSD command clears the S buffer, and the S buffer is automatically cleared periodically while running sample programs and when SIMC transfers data to the D file in flash memory.

STR File

The STR file is a short status log file stored in RAM. This log includes power cycling, time changes and notes of any hardware or firmware events. Note that the GETSD command clears the STR buffer, and the STR buffer is automatically cleared periodically when SIMC transfers data to the ST file in flash memory.

ST File

The ST file is a circular status log file in flash memory. Data in the ST file is periodically copied to the SDHC memory card.

SD File

This is the data file on the SDHC memory card. This file may take tens of minutes to read through RS232.

WRITE

Writes data to a file. Not all files support this command.

READ

Retrieves data from a file

ERASE

Erases a file.

Copyright 2021 SOUNDNINE INC

RUN

Runs a script file. Only allowed with the F file.

DUMPFLASH

A utility command to retrieve the entire contents of flash memory. This allows significant data recovery if the D file is accidentally erased. This command takes about ten minutes to run.

Command Table

(Not including calibration setting commands)

Command	Blocks	Parameters	Description
GETCD			Displays configuration settings
GETSD			Displays status data
GETEC			Displays event counters
VER			Displays hardware and firmware version
ERASE CONFIG			Resets all configuration to default values, does not change calibration values
PERIOD		1-3600	Sets the sample period in seconds
START			Starts logging
STOP			Stops logging
TIME			Sets or reads the time
PWROFF			Same as SLEEP. Terminates active mode (IM Service or Host Service)
SLEEP			Same as PWROFF. Terminates active mode (IM Service or Host Service)
RESETEC			Resets (clears) the event counters
RESET			Resets the modem – ending all processes and forcing return to sleep mode.
WRITE	FILE	F, D, A	Writes to a file.
READ	FILE	F, D, A, S, ST, STR, SDD, SDS	Reads a file: F – f file (script / utility file) D – D file (sample data buffer) A – A file (program script) ST – Status buffer STR – Status ram buffer SDD – SD card sample data file SDS – SD card status data file
ERASE	FILE	D, MEM, ST, CAL, CONFIG	Erases a file (ERASE MEM clears all files except those on the SDHC memory card)
RUN	FILE	F, A	Runs a file as a script. RUN F runs F file as a simple command script. RUN A runs the A file as a data collection script.
OPEN		Port, baud	Opens a serial pass through mode Port: 0, A, 1, B, 2, IM

Copyright 2021 SOUNDNINE INC

			Baud: any multiple of 1200 up to 115200 Press escape to exit the pass through mode.
DUMPFLASH	FILE		Outputs the entire contents of the flash memory. May take tens of minutes to complete.
AMODE			Accelerometer mode - reserved for future use
ARATE		1-50	Accelerometer sample rate – reserved for future use
ASCALE		0-3	Sets full scale range of the accelerometer (in g- for gravity) 2g,4g,6g,8g
MSCALE		0-3	Sets full scale range of the magnetometer (in gauss) 2g, 4g, 8g, or 12g

Configuration Settings

Note the name of each configuration setting is also a command to modify that setting. Use a space or = between the command and parameter value:

```
ID 01
```

and

```
ID=01
```

Are both acceptable.

Command	Parameter default value in ()	Description
PERIOD	1-10080	Sets the sample period in minutes (10080 = 1 week)
AMODE		Accelerometer mode - reserved for future use
ARATE	1-50	Accelerometer sample rate – reserved for future use
ASCALE	0-3	Sets full scale range of the accelerometer (in g- for gravity) 0=+/- 2g 1=+/- 4g 2=+/- 6g 3=+/- 8g
MSCALE	0-3	Sets full scale range of the magnetometer (in gauss) 0=+/- 2g 1=+/- 4g 2=+/- 8g 3=+/- 12g

Copyright 2021 SOUNDNINE INC

Calibration Settings

Note the name of each calibration setting is also a command to modify that setting. Use a space or = between the command and parameter value:

```
ASX 0
```

and

```
ASX=0
```

Are both acceptable.

Setting	Range	Description
ACX	-500 to 500	Accelerometer X offset
ACY	-500 to 500	Accelerometer Y offset
ACZ	-500 to 500	Accelerometer Z offset
ASX	14000 to 18000	Accelerometer X offset
ASY	14000 to 18000	Accelerometer Y scale
ASZ	14000 to 18000	Accelerometer Z scale
BCX	-500 to 500	Magnetometer X offset
BCY	-500 to 500	Magnetometer Y offset
BCZ	-500 to 500	Magnetometer Z offset
BSX	14000 to 18000	Magnetometer X offset
BSY	14000 to 18000	Magnetometer Y scale
BSZ	14000 to 18000	Magnetometer Z scale

Sample Programming

Basic Sample Program Structure

Sample programs are little more than a list of commands representing a non-branching and non-looping algorithm. Each line of a program represents a single command. When a command is completed the next command is processed. This repeats until the end of the file is reached. Lines starting with a '/' or ';' are treated as comments.

Sample Program Commands

Command	Parameter	Description
`Delay`	Delay length in milliseconds	Pauses the program (open ports are monitored during the pause)
Open	Port, baud	Opens a serial port at the specified baud rate. Port: 0,1,2,A,B or IM Baud: any multiple of 1200 up to 115200 Ex: `OPEN IM 19200`
SEND	Port, string	Sends a string to an open serial port Ex: `SEND IM "FCL\r"`
WAITFOR	Port, String, max wait	Waits for a specified data string from an open port with a maximum wait time in milliseconds. Ex: `WAITFOR IM "S9>" 10000`
SAVE	Port	Records data logged from the specified port to the D file. No data is saved if logging is disabled on the specified port!

Copyright 2021 SOUNDNINE INC

PARSER	Port, Parser name	Specifies a data parser for a port. The parser name tells analysis software how to process the data from the specified port. Ex: `PARSER IM "Ultimodem"`
CLEARBUFFER	Port	Erases the contents of the serial receive buffer for the specified port. Data previously saved with the SAVE command is not erased.
LOG	Port, ON/START/OFF/STOP	Enables or disables data logging on the specified port. Note the logging setting is overridden by the debuglevel setting: debuglevel >1 forces continuous logging.
VBLOG	-	Writes current battery voltage, external voltage, and currents to the sample log in this format: `<ADC v='2'>7.017,7.02,0.00,0.00</ADC>`
IHLOG		Writes current internal temperature and humidity to the sample log in this format: `<IRH v='1'>22.32,57.09</IRH>` Data are temperature, humidity; Units are degrees C and percent relative humidity
ACMLOG		Writes current accelerometer data to the sample log in this format: `<ACM v='0'>-7690,-6498,-374</ACM>` Data are ax, ay, az; units are milli-g
TIMESTAMP		Writes the current time to the log in this format: `<TIME v='0'>2021-04-01T12:22:11</TIME>` Note the start time of each sample is automatically recorded in the log.

Example Sample Program

This is a sample program which records battery voltages, internal humidity and retrieves data through the inductive modem from XT sensors like XTP or XIM-CTD's. It also measures IM line noise with the Ultimodem MLN command.

```
parser IM Ultimodem
adclog
irhlog
open im 19200
delay 1000
send im "\r"
waitfor im "S9>" 1000
delay 100
send im "MLN\r"
delay 2000
save im
send im "XT2\r"
delay 10000
save im
close im
```


Copyright 2021 SOUNDNINE INC

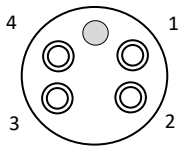
Hardware

Mechanical Specifications

Materials	Acetal, PET
Connector:	MCBH-4M
Length	24cm housing plus 12.5 cm with MCBH dummy plug installed
Diameter	1.95 inches (49.53mm)
Mass:	700g (not including cable clamp)
Battery:	2x Lithium AA 3.6V
Battery Endurance	1-3 years, depending on application
External Power Input	3.6V to 62V DC
Cable Size:	3mm to 15mm (standard)
	10mm to 26mm (large)

Electrical Connector

The SIMC serial port connector is Subconn brand MCBH-4M. This connector mates with MCIL-4F cables. The SIMC uses the same connectors and cables as the Ultimodem.



Male Face View
MCBH 4M

1 Common
2 RS-232 Transmit out
3 RS-232 Receive in
4 External Power +

Serviceable Parts

Battery

The SIMC uses two AA 3.6V lithium battery. Saft LS14500 or equivalent. The LS14500 is rated 2.6 amp-hours, we usually de-rate to 2.0 amp hours to account for self-discharge and temperature effects.

O-Ring

The SIMC uses #126 buna o-ring. We recommend Molykote M44 lubricant on the o-ring. Excess lubricant is not desirable, use just enough to wet the surface of the o-ring on all sides.

Copyright 2021 SOUNDNINE INC

Cable Clamp

The cable clamp clamps both to the SIMC housing and to the mooring cable. It is machined from glass-filled polyethylene for high strength and excellent impact resistance.

The SIMC housing is 1.95” diameter from the bottom endcap to about halfway to the top IM endcap, where the diameter increases to 1.98”. This diameter change prevents the cable clamp from tearing off the labels on the outside of the housing.

All cable clamp hardware is 316L stainless (A4). All bolts are M5x0.8mm thread. Please do not confuse these with inch size #10-32 thread!

Replacement Parts List

Item	Description	Soundnine Part Number	McMaster-Carr Part Number
O-ring	#126 Buna o-ring	20A9C	9452K91
Desiccant	1”x1.75” indicating silica gel	206B6	3492T12

Copyright 2021 SOUNDNINE INC

Firmware Updates

Firmware update files are text files with firmware encoded in ASCII hex. They are sent to the modem through the RS232 serial connection. Follow these steps to perform a firmware update:

1) Connect the RS232 cable
2) Open a terminal program (we prefer TeraTerm) and select the appropriate COM port
3) Set the port flow control to Xon/Xoff or 'SOFTWARE HANDSHAKING' (under Setup->Serial Port in TeraTerm).
4) Press enter to get a S9> prompt from the sensor.
5) Type the STOP command to make sure the instrument is not sampling.
6) Type the VER command to check the current firmware version of your sensor
7) Send the firmware update file to the sensor. (no encoding – in TeraTerm use File->Send File)
8) Wait for the file transmission to finish.
9) Enter the RUN F command to initiate parsing, integrity checking and device type verification. This may take 10 to 15 seconds. If the file is OK the sensor will respond with:
   `Confirmed - ready to program`
10) Enter the PROGRAM command to start the firmware update. The firmware update takes only a few seconds. Do not disconnect the battery or USB cable within 10 seconds of sending the PROGRAM command, doing so may corrupt the firmware and disable the controller.
11) After the firmware update completes the sensor will be in sleep mode. Press a key to wake the sensor and use the VER command to verify the new firmware version.

Copyright 2021 SOUNDNINE INC